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COMB HONEY.

BY

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ENTOMOLOGY,
Washington, D. C., April 16, 1912.

SIR: I have the honor to transmit herewith a manuscript entitled "Comb Honey," by Geo. S. Demuth, apicultural assistant in this bureau.

In view of the increasing demand for the finest grades of comb honey and of a decrease in the amount of comb honey produced, it seems timely to present to professional beekeepers an analysis of the best practice as well as to point out some essentials to the production of maximum crops of the best grades. I recommend the publication of this paper as a Farmers' Bulletin.

Respectfully,

L. O. HOWARD,
Entomologist and Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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COMB HONEY.

INTRODUCTION.

The present tendency in beekeeping is decidedly toward the production of extracted honey rather than of comb honey. The recent activity among beekeepers toward specialization, which necessitates the establishing of out-apiaries, and the rapidly increasing demand for extracted honey are among the factors bringing about this condition. Enormous quantities of honey are now used for manufacturing purposes, and this demand is, of course, solely for extracted honey.

If the general public finally becomes convinced of the purity and wholesomeness of extracted honey, this will become a staple article of food. Comb honey to command the higher price—proportionate to the greater cost of production—must justify the extra cost to the consumer by its finer appearance. The consumer of extracted honey is not concerned as to the straightness or finish of the combs in which it was originally stored, but by virtue of its appearance there will probably always be a good demand for the finest grade of comb honey where appearance is the chief consideration. Present tendencies therefore emphasize the desirability of producing comb honey of the most attractive appearance possible.

Well-filled sections of comb honey with delicate white comb and perfect cappings are obtainable only during a rapid honey flow of sufficient duration to insure their completion. The production of comb honey, the appearance of which is sufficient to justify its extra cost, requires a combination of conditions that are peculiar to rather limited areas, outside of which the beekeeper will find it decidedly advantageous to produce extracted honey.

Comb-honey production should not be attempted in localities where the honey flow is very slow or intermittent, where the character of the honey is such that it granulates quickly in the comb while it is on the market, where the honey is dark or "off color," or where honeys from various sources are mixed if these different sources produce honey of different colors and flavors. Local market conditions may of course in some instances be such as to make it seem advisable to produce comb honey in limited quantities in a locality that is not well suited to comb-honey production, but the beekeeper who produces comb honey for the general market should first be sure that his is a

comb-honey locality. Even in the best localities during an occasional season conditions are such that it is not possible to produce comb honey of fine appearance. Some comb-honey specialists find it profitable to provide an equipment for extracted honey for such an emergency. In some cases comb honey is produced only during the height of the season, when conditions are most favorable, extracting supers being used both at the beginning and close of the honey flow.

While the professional beekeeper is thus curtailing the production of indifferent grades of comb honey, bee diseases are rapidly eliminating the careless producers. From the present indications, therefore, it would seem certain that there must be a gradual elimination from the markets of all inferior and indifferent comb honey—grades that must compete directly with extracted honey. This should mark a new era in the production of the best grades of comb honey in the localities that are peculiarly adapted to comb-honey production. The beekeeper who is thus favorably located will do well to consider the possibilities of future market conditions for a fancy grade of comb honey.

The following discussion is necessarily but a brief outline of modern apparatus and methods and of course can not in any sense take the place of the broad experience necessary in profitable comb-honey production. It is assumed that the reader is more or less familiar with the more general phases of beekeeping. (See Farmers' Bulletin No. 447. This bulletin also contains a complete list of publications of the Department of Agriculture on beekeeping.)

APPARATUS FOR COMB-HONEY PRODUCTION.

Shop and Honey House.

A building containing storage space for apparatus, a well-lighted and ventilated workshop as well as a honey room, is a necessity in comb-honey production. The arrangement and location of the shop and honey house will depend upon local conditions and circumstances. The usual mistake is in constructing these too small. In the North the shop and honey house is usually built over the wintering repository or cellar. Since rats or mice would do great damage to the contents of such a storehouse, the construction should be such as to exclude them. If a concrete foundation is used and the sills are embedded in a layer of "green" mortar, no trouble of this kind should be experienced. If a series of out-apiaries are operated for comb honey, the supers, extra hives, etc., are usually kept in one building located near the home of the beekeeper. This serves as a central station and storehouse, the supplies being hauled to and from the apiaries as needed. This building may be supplemented by a

very small building at each apiary, though in comb-honey production this is not really necessary.

The honey room should be so located that it will receive the heat from the sun, preferably an upstairs room immediately under the roof. When so located a small hand elevator should be installed for taking the honey up and down. The room should be papered or ceiled inside to keep out insects and to permit fumigation if necessary and should contain facilities for artificially heating in case continued damp or freezing weather should occur before the honey is marketed. The honey room should be provided with ample floor support for the great weight that may be placed upon it.

Hives.

A beehive must serve the dual purpose of being a home for a colony of bees and at the same time a tool for the beekeeper. Its main requirements are along the line of its adaptation to the various manipulations of the apiary in so far as these do not materially interfere with the protection and comfort it affords the colony of bees. Since rapid manipulation is greatly facilitated by simple and uniform apparatus, one of the fundamental requirements of the equipment in hives is that they be of the same style and size, with all parts exactly alike and interchangeable throughout the apiary. While the hives and equipment should be as simple and inexpensive as possible, consistent with their various functions, a cheap and poorly constructed beehive is, all things considered, an expensive piece of apparatus.

In this country the Langstroth (or L) frame ($9\frac{1}{8}$ by $17\frac{5}{8}$ inches) (fig. 1) is the standard frame and throughout this paper frames of brood will be discussed in terms of this size of frame. The advantages of standard frames and hives are so great that the beekeeper can not afford to ignore them for the sake of some slight advantage of another size.

There is, however, a wide difference of opinion as to the number of frames that should be used in a single hive body. The wide variation in the building up of colonies previous to the honey flow in different localities and seasons, the race of bees, and the skill of the beekeeper are all factors entering into this problem, which make it improbable that beekeepers will ever fully agree on this point. The races that build up more rapidly in the spring are, of course, other things being equal, able to use to advantage a larger brood chamber than the races that are more conservative in brood rearing. It is also noticeable that within certain limits as the beekeeper's skill in building up his colonies for the flow increases, so the size of the brood chamber best adapted to his purpose increases. In other words, while the careful and skillful beekeeper may succeed in having large brood

chambers well filled with brood at the beginning of the honey flow, the less skillful beekeeper under similar conditions may be doing well to approximate this condition with a much smaller brood chamber.

For comb-honey production the brood chamber should be of such a size that by proper management it may be well filled with brood at the beginning of the honey flow, so that the brood and surplus apartments may be definitely separated. A brood chamber may be considered too large if by proper management it is not on an average fairly well filled with brood at the beginning of the honey flow, and too small if it provides an average of less room than the colony is able to occupy with brood previous to the honey flow. Unless the beekeeper practices feeding, a brood chamber that does not contain sufficient room for both winter stores and brood rearing during late summer and autumn may also be considered too small. It may be well to note that by this standard if the brood chamber seems to be too large the fault may lie in the management during the previous autumn, winter, or spring. Of course the brood chamber that is barely large enough for one colony will be too large for another in the same apiary or the character of the season may be such that all brood chambers may be too large for best results one season and too small the next, so an average must be sought. While by manipulation good results may be secured by the use of any of the sizes in common use, any great departure in either direction from the size best suited to conditions of a given locality necessitates an excessive increase in labor to give best results. There is at the present time

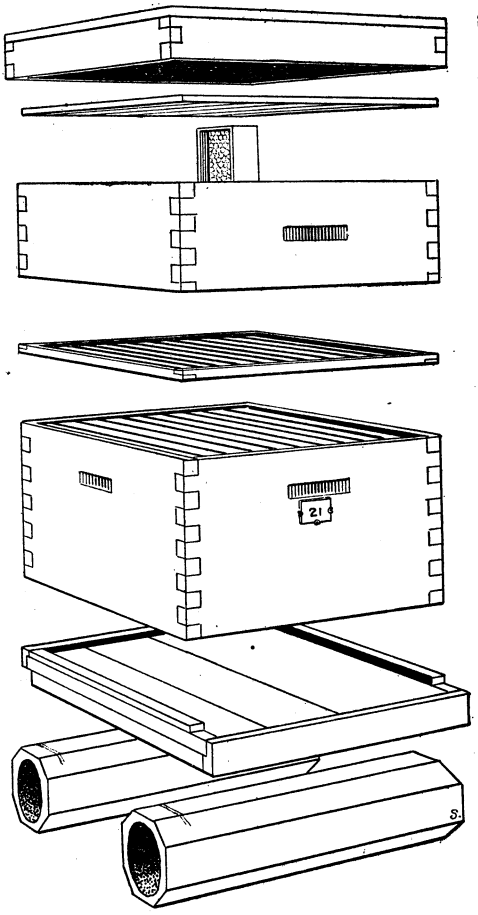

FIG. 1.—A 10-frame hive with comb-honey super and perforated zinc queen excluder. (From Phillips.)

a strong tendency toward the use of the 10-frame hive body as a medium-sized brood chamber which may be used as a unit of a larger elastic brood chamber when necessary.

The comb-honey producer is more exacting as to certain details of construction of hives than is the producer of extracted honey since it is more necessary for him to handle individual brood frames during the honey flow. The spaces [1] above and between the top bars of the brood frames must be accurate or they will be bridged with burr and brace combs and these filled with honey. Burr and brace combs make the removal and readjustment of the super and the manipulation of frames a slow and disagreeable task, to say nothing of the waste of material, which should have been placed in the sections in the beginning. The use of the slatted honey board (fig. 2), while preventing brace combs between itself and the super, does not prevent the building of burr and brace combs between and above the top bars of the frames. This trouble is largely eliminated by proper spacing. Most hive manufacturers are at present making the top bars of the brood frames of such a width that the spaces between them is from one-fourth to five-sixteenths inch with the same spacing above them. The difficulty, however, is in maintaining this spacing with any great degree of accuracy. Self-spacing frames [2] are a partial solution of this difficulty. In some localities, however, the ordinary self-spacing frames are so badly propolized as to render their removal from the brood chamber difficult as well as materially to interfere with the proper spacing. The advantages of such frames are then nullified, while their disadvantages are retained or even intensified. In such localities metal spacers having but small surfaces of contact are sometimes used. Some beekeepers prefer omitting the spacers entirely. However, some of the difficulties arising from the use of self-spacing frames are the result of carelessness on the part of the operator in

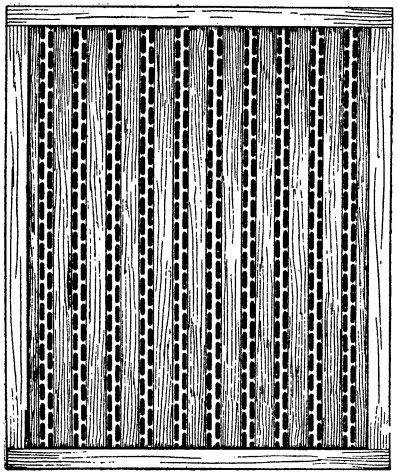

FIG. 2.—Perforated zinc queen excluder. (From Phillips.)

[1] A bee space, or that space in which bees are least inclined to put comb or propolis, is perhaps a scant one-fourth inch. In hive construction one-fourth or five-sixteenths inch is usually used.

[2] These are so constructed that the end bars are one-fourth or five-sixteenths inch wider than the top bars throughout a portion of their length or furnished with projections of metal fitted to the edges of the frame. In either case the adjustment is such that when the frames are crowded together in the hive the spaces between the top bars will be correct.

not crowding the frames together properly when closing the hive after having handled the frames.

SECTIONAL HIVES.

The sectional hive in which the brood chamber is composed of two or more shallow hive bodies, making it horizontally divisible, offers some advantages, especially to the comb-honey specialist. Most of the ordinary manipulations can be performed readily with such hives without removing the frames. One of their greatest advantages in comb-honey production is the rapidity with which the apiarist can examine the colonies for queen cells if natural swarming is to be controlled by manipulation. They are also very elastic, the units or sections usually being of 5-L frame capacity, permitting a brood-chamber capacity of 5 or any multiple of 5-L frames. Among the disadvantages of these hives are the extra cost owing to the greater number of parts necessary in their construction and the difficulty in maintaining proper spacing without the use of top bars on the frames heavier than would seem advisable in the middle of the brood nest.

Sections and Supers.

There is a wide variation in the style of sections and the supers designed to contain them. This, while to some extent brought about by different local conditions, is largely due merely to the notions of individual beekeepers. Comb-honey apparatus could probably be standardized without sacrificing any really vital features.

BEEWAY *v.* PLAIN SECTIONS.

There are two general styles of sections in common use differing in the method of spacing—the beeway section in which the spacer is a part of the section itself (fig. 5), and the plain in which the spacer

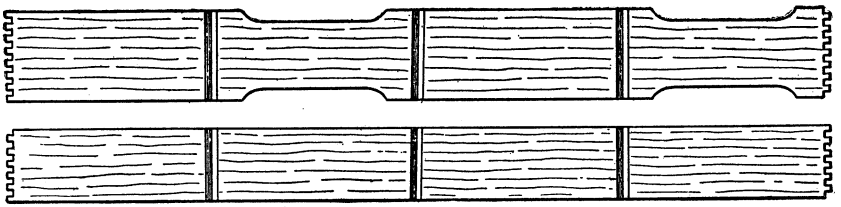

FIG. 3.—Beeway and plain sections, unfolded. (Original.)

is a permanent part of the separator (fig. 4). Each style has its advocates and each offers some advantages.

Some of the advantages of the plain (fig. 3) over the beeway sections are: (1) They are simpler in construction, therefore costing

less. (2) The edges being plain with no insets, the plain sections are more easily cleaned of propolis when being prepared for market and are especially adapted to cleaning by machinery. (3) By leaving the spacers in the super, sections of the same honey content occupy less space in the shipping case, thus reducing the cost of packages. (4) The plain section is adapted to an arrangement permitting freer communication lengthwise of the row of sections, especially at the corners (p. 15).

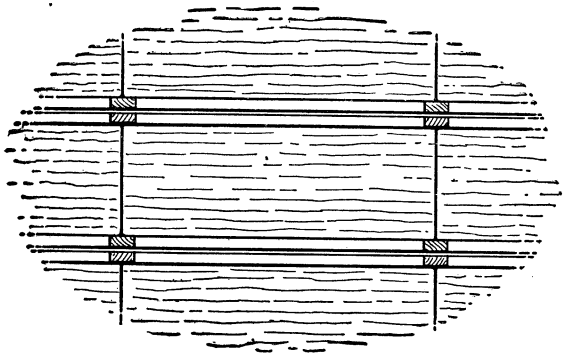

FIG. 4.—Plain section in super, showing method of spacing. (Original.)

Some of the advantages of the beeway sections (fig. 3) are: (1) The honey is somewhat less liable to injury by handling. (2) Being wider at the corners where folded, they are stronger. (3) Some markets, being accustomed to the larger cases necessary to contain a given number of beeway sections, object to the smaller package containing the same number of plain sections, simply because it is smaller.

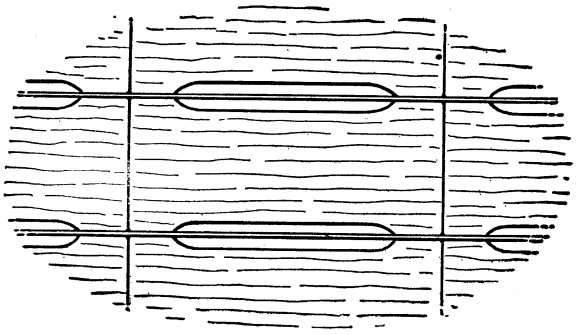

FIG. 5.—Beeway section in super, showing method of spacing. (Original.)

DIMENSIONS OF SECTIONS.

Sections of various dimensions are in use by beekeepers, but the sizes in general use are the $4\frac{1}{4}$ inches square and the 4 by 5 inches. Some producers prefer the 4 by 5 sections because of the more pleasing appearance of the oblong package (fig. 6). The standard widths of the $4\frac{1}{4}$ by $4\frac{1}{4}$ inches section are $1\frac{7}{8}$ inches in the beeway style and $1\frac{1}{2}$ inches in the plain section. The extra width in the beeway style is for the purpose of spacing and does not add to the thickness of the comb. The 4 by 5 is $1\frac{3}{8}$ or $1\frac{1}{2}$ inches wide in the plain style and not much used in the beeway style. The $1\frac{3}{8}$ width of the 4 by 5 section contains practically the same amount of honey when filled as the

4¼ by 4¼ by 1½ plain or the 4¼ by 4¼ by 1⅞ beeway, assuming of course that all are used with separators and filled under like conditions. Since there are well-defined limits as to the thickness of the combs most profitable to produce, the area of one comb surface in a section weighing about a pound is usually from 16 to 20 square inches, the exact size and shape being an adaptation to given space in the super. The thinner combs, showing more comb surface, have the appearance of being larger and a greater number can be accommodated on a given hive. Honey in such combs may also be ripened sooner and possibly better than in thicker combs. They, however, require more foundation for each pound of honey produced and a slightly greater amount of wax, in proportion to the honey, to complete them. Also

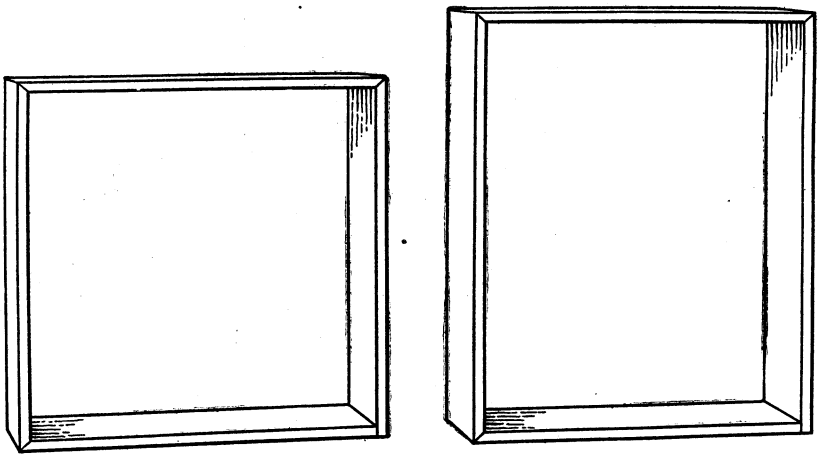

FIG. 6.—Square and oblong sections. (Original.)

the thinner the comb, the greater the difficulty with the sheets of foundation swinging to one side on account of uneven work on the two sides or because the hives do not stand level.

SUPERS.

The main points of difference between the various types of comb-honey supers are in (1) the method of supporting the sections, (2) the amount of protection afforded to the outside of the section, and (3) the degree of free communication from section to section within the super.

The Method of Support.

Sections are supported either by means of cross supports under the ends of the sections or by a slat of proper width supporting each row of sections. The T super (fig. 7), so called from the shape of a cross section of the strip of tin used to support the sections, is illus-

trative of the first, while the supporting slats, section holders (figs. 8, 9 and 10), and wide frames (fig. 11) are illustrative of the second type of support.

Protection.

The T super and others of this type offer no protection against propolizing to either the top or bottom of the sections, the section

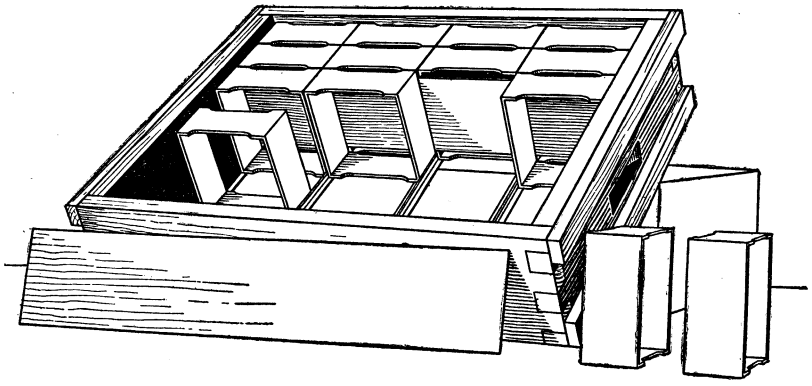

FIG. 7.—The T super. (Original.)

holder or slat (figs. 8, 9, and 10) protects the bottom, while in the wide frame (fig. 11) the entire outer surface of the sections is protected except at the edges. The greater the protection afforded the

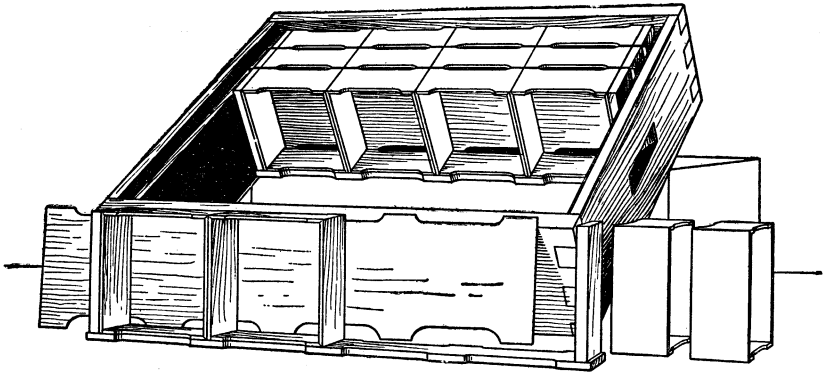

FIG. 8.—Super with section holder for beeway sections. (Original.)

section, the more complicated and expensive the super, and the more complicated supers require more labor in cleaning of propolis and filling with sections. On the other hand, sections of honey produced in properly constructed wide-frame supers are much more easily cleaned of propolis, and ordinarily present a neater appearance when packed for market.

Free Communication Within the Super.

The use of closed-top sections (1-beeway) and solid separators, making each section a separate compartment with openings for the bees at the bottom only, illustrates one extreme; while the sections with openings on all four sides (4-beeway) used without separators

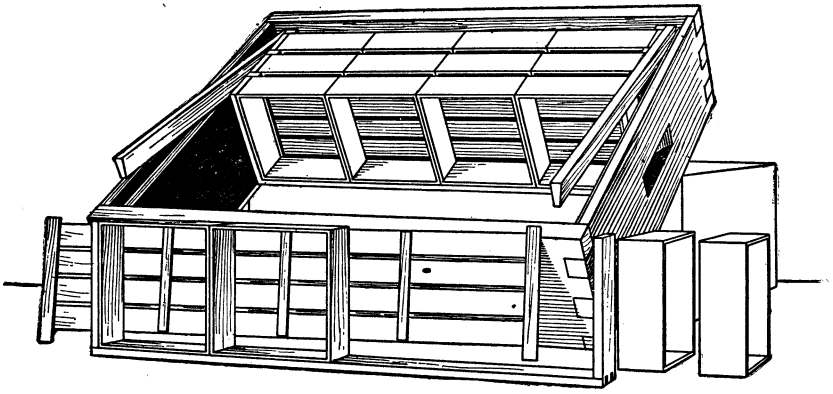

FIG. 9.—Super with section holder for square plain sections. (Original.)

illustrate the other extreme as to free communication; and between these extremes are various intermediate types.

It would be desirable so to adjust the sections that when filled with honey a row of them would, so far as the bees are concerned,

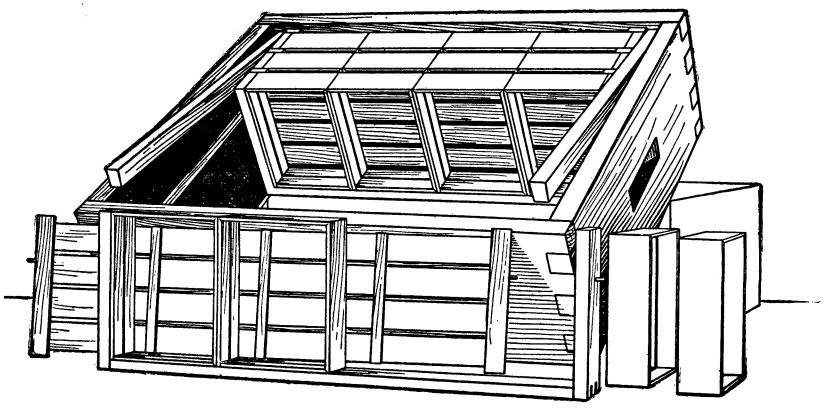

FIG. 10.—Super with section holder for oblong plain sections. (Original.)

be equivalent to a single comb, that the bees might have the same free access to the outside row of cells from all sides as they do the other cells and might pass up or down from any section and the full length of the row, as well as around the ends. While, under the same conditions, such free access to the outside row of cells from all

sides would result in the sections being slightly better filled than with the ordinary adjustments, such an arrangement presents some mechanical difficulties and would add considerable to the first cost of the supers. If separators were not necessary, such an adjustment of sections could be readily accomplished. In Europe a type of separator having transverse openings corresponding to the upright edges of the sections is used to give free communication lengthwise of the row of sections. In this country some such separators are used as well as a separator made of wire cloth so spaced between the rows of sections as to give free communication along the rows, as well as from one row to another. These, however, are not widely used in the United States.

The plain section, when used in connection with the "fence" separator (fig. 4), having the upright posts considerably shorter than the height of the section, offers a fair compromise as to free

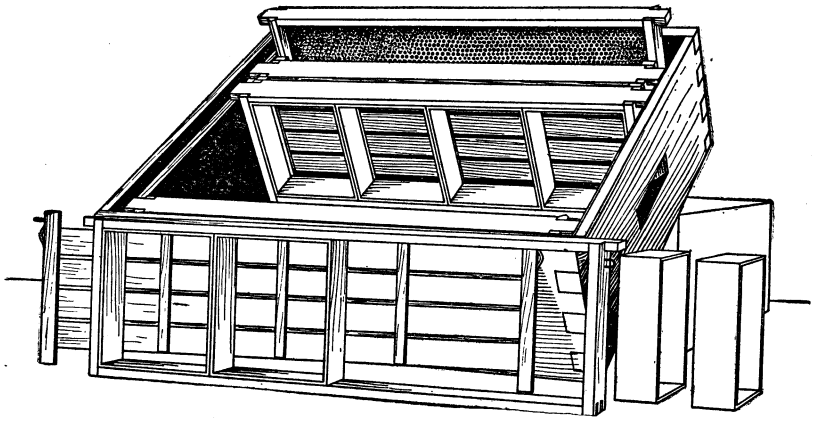

FIG. 11.—Combination super with wide frames for oblong plain sections. (Original.)

communication within the super. Most of the comb honey produced in this country, however, is produced in sections which offer no communication from section to section lengthwise of the super, being produced in the regular 2-beeway section, having openings at the top and bottom only (figs. 7 and 8).

THE USE OF SEPARATORS.

Separators are made of strips of tin or wood and are used between the rows of sections to compel the bees to build the combs straight and all within the section. The thicker the combs the greater becomes the necessity for separators. While an expert can produce very uniform comb honey without separators during a heavy honey flow by using very narrow sections, it is usually not advisable to do

so on account of the resulting large percentage of imperfect combs, especially during poor and indifferent seasons and at the close of any season. The use of separators results in a much more uniform product.

SHALLOW EXTRACTING SUPERS.

Some comb-honey producers add to their equipment one shallow extracting super for each colony. These are a great convenience in a comb-honey apiary and may be used for the following purposes: (1) To keep the brood chamber free of honey before the beginning of the main honey flow; (2) to use at the beginning of the honey flow to induce the bees to begin work promptly in the supers; (3) to use at the close of the honey flow instead of the last comb-honey super; (4) to use during any flow of inferior honey or honeydew; (5) to use during very poor seasons when first-class comb honey can not be produced.

COMBINATION SUPERS.

Other comb-honey producers provide each comb-honey super with two shallow extracting combs. These are placed one on each side of the super with the sections between them (fig. 11). The purpose of this arrangement is to induce the bees to begin work in the super promptly without the use of "bait sections" (sections containing comb previously drawn) or an extracting super and also to do away with the usual poorly finished sections in the corners and outside rows. One great advantage of this system over the use of an extracting super to start early super work is that the combs are not removed. When shallow extracting supers are used for this purpose, they are removed as soon as the bees have started well in them and a comb-honey super substituted. This brings back much the same conditions existing before giving the extracting super, and while some colonies will begin work in the sections promptly when the change is made, many colonies hesitate about beginning the new work almost as though the extracting super had not been used. Such colonies are thus thrown out of "condition" (p. 19) and may begin preparations to swarm. The use of these combs in supers that are added subsequently allows the apiarist to place the empty super over the one already on the hive until the bees begin work therein without seriously crowding the super room, because each super thus added contains room in the form of empty comb into which the new nectar may be stored at once (see p. 42).

Other Apparatus.

Among the other apparatus needed in commercial comb-honey production are a honey extractor, wax press, bee escapes, and escape

boards (fig. 12), queen-excluding honey boards (fig. 2), feeders, tools, etc. It is not necessary to provide queen-excluding honey boards for each colony unless some special system is followed, yet a few excluders are very desirable for various special manipulations. Good feeders may be had by using tin pans in connection with an empty super. A handful of grass should be placed on the sirup to prevent the bees from drowning. In addition to these appliances in the northern States, if the hives are single walled, some means of protection is necessary if the colonies are wintered out of doors.

Preparing Supers.

FOLDING SECTIONS.

Section presses and foundation fasteners are sometimes combined in one machine by which the section is pressed together square and the foundation is fastened by a single operation. Usually, however, they are separate machines requiring that each section be handled twice before it is ready to be placed into the super. Ordinarily the one-piece sections must be dampened before folding, as otherwise the breakage is considerable and the sections are greatly weakened by folding. A crate of sections as it comes from the factory may be dampened by removing one side so as to expose the V-shaped grooves, then directing a small stream of hot water into these grooves. Care should be taken that only the thin portion where the section is folded be dampened. Another very satisfactory method of dampening sections is to wrap the crates containing them in a wet blanket the day before they are to be folded.

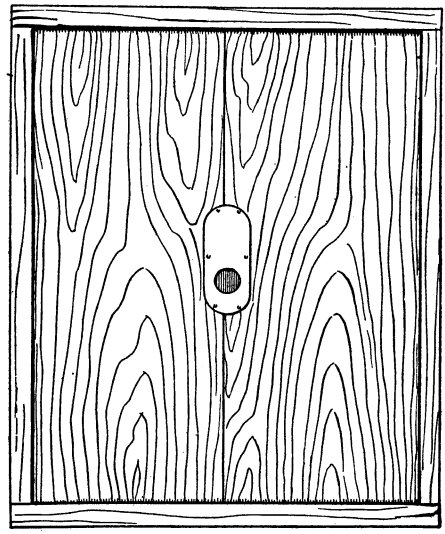

FIG. 12.—Bee escape board for removing bees from supers. (From Phillips.)

FASTENING FOUNDATION IN SECTIONS.

The use of comb foundation in full sheets filling each section as nearly as possible is considered a necessity in the production of fancy comb honey. This foundation should be as thin as can be used without being gnawed or torn down by the bees. The sheet of foundation is usually fastened centrally at the top of the section, leaving only

enough space at the sides to allow it to swing freely without binding and about three-sixteenths to one-fourth inch at the bottom to allow for stretching while being drawn out. To secure better attachment of the comb to the bottom of the section, a bottom starter about five-eighths inch wide may be used. In this case the top starter should reach to within three-sixteenths to one-fourth inch of the bottom starter. In some localities the character of the flow is such that but little is gained by the use of the bottom starter, while in other localities it is difficult to produce honey that will stand shipment well without it.

The various types of apparatus usually used for fastening foundation in the sections make use of a heated metal plate which, after melting the edge of the sheet of foundation, is withdrawn, allowing the melted edge to be brought quickly in contact with the section. This fastens one edge of the sheet of foundation firmly to the wood. Foundation fasteners employing this principle may be simply a hand apparatus consisting of a metal plate of proper size provided with a handle, the operator transferring the tool from the source of heat to the edge of the foundation. Or the principle may be incorporated in a more or less complex machine which provides for the maintenance of the proper temperature of the heated plate, its movement to melt the edge of the foundation and a proper support for the section and foundation during the process. For the purpose of securing better filled sections of honey various methods of attaching the sheet of foundation to the sides as well as the top of the section have been devised, but are not extensively used by producers. Among these methods are fitting the sheet of foundation in place, then directing a fine stream of melted wax along its edges, or the use of split sections in which a sheet of foundation is continuous through a row of sections, extending through their sides and top.

Some super construction is such that the sections may be placed directly into the super by the operator who puts in the foundation. This work is usually done during the winter months when the bees require no special attention. Enough supers should be provided to take care of the largest possible crop, even though it is not often that all are used the same season. The beekeeper who is operating several apiaries can not afford to take time to prepare supers for the bees during a good honey flow. Supers of sections thus prepared in advance should be kept clean by storing them in piles and keeping the piles covered from dust.

MANIPULATION OF THE BEES.

It is important to note that there are four essential factors entering into the securing of a crop of honey: (1) A sufficient amount of bloom of healthy and well-nourished nectar-secreting plants growing in soil to which they are adapted and within range of the apiary.

(2) Weather conditions favorable to nectar secretion and bee flight. (3) A large number of workers in excess of those needed for the routine work of the colony. (4) Conditions of the colony making the storing instinct dominant. If any one of these factors is absent, the effect of the other three is immediately nullified, and the amount of honey secured will vary as these factors are present at the same time in greater or less degree or as the time during which they are all present is longer or shorter. It is therefore possible to have each of these factors present at some time during the season without securing a crop of honey and the period of time during which they are all present at the same time is usually quite short.

Grouping the first and second factors we have a combination usually spoken of as the locality and season. These factors are largely beyond the control of the beekeeper except as he may choose a location in which both are usually present at some time or times during the season, may take advantage of the plants of several locations by practising migratory beekeeping, or may improve a given locality by directly or indirectly increasing the amount of nectar-secreting plants, such as buckwheat, alsike clover, sweet clover, or alfalfa.

Grouping the third and fourth factors we have conditions capable of being brought about by manipulation and for which the beekeeper is more directly responsible. The beekeeper's skill therefore lies in supplying and maintaining these factors throughout the short period during which the bees may store more than they consume. He should know which plants may be expected to furnish the nectar for his crop of honey, that his various manipulations may be properly timed. It should be noted that the shorter the duration of the honey flow, the greater becomes the necessity of having the colonies in proper condition at its beginning and keeping them so until its close. However lavish nature may be with the secretion of nectar and fine weather, it is of little avail if the beekeeper fails to secure a large force of workers to gather and store his crop or, even having provided workers, if he fails to keep his forces together and contented, bending all their energy in the one direction of gathering and storing honey. It is a common occurrence among inexperienced beekeepers to have the colonies become strong enough to work in the supers only after the flowers have ceased blooming or to see strong colonies during a good honey flow doing nothing in the supers simply because conditions are not such as to make the storing instinct dominant.

So far as the skill of the beekeeper is concerned in the production of the crop of honey in a given location, every manipulation of the season should be directed (1) toward securing the greatest possible number of vigorous workers at the proper time, and (2) keeping the entire working force of each colony together and contentedly at work throughout the given honey flow.

Securing Workers for the Honey Flow.

Of course, the shorter the period for brood rearing previous to the honey flow, the more serious the problem of getting the colonies strong enough. Adverse weather conditions greatly retard brood rearing and thus have the effect of shortening this period. On the other hand, in some localities the main honey flow comes so late in the season that the colonies may even be divided and both divisions built up.

In most comb-honey localities the season is short and there is usually during the season only one honey flow that furnishes any considerable surplus suitable for comb honey, with perhaps other honey flows either very meager or furnishing honey unsuitable in color. The early minor flows are in such localities utilized in brood rearing in preparation for the main flow, and those occurring after the main flow may be utilized for winter stores, or if sufficient in quantity some surplus may be secured. In localities where the season is made up of a series of honey flows of almost equal importance and with sometimes a long interval between, the problem of securing workers for the harvest is rendered more complex, since the process must be repeated for each crop or the colonies kept very strong throughout the season. As a rule such localities are not the best for comb-honey production.

The workers that gather and store the crop of honey are those that emerge during the few weeks preceding and during the first part of the honey flow. Unless it is of unusual duration, the eggs that produce these workers are all laid before the honey flow begins, since those which develop from eggs laid later are not ready for work until after the close of the flow. On the other hand, the workers that emerge six weeks or more before the honey flow will have died of old age or be too old to be of much value during the flow. Their services, however, are of great value provided they expend their energy to the best possible advantage in rearing brood. If brood rearing ceases or is greatly restricted during this period, a colony that has been strong earlier in the season is rendered almost worthless as gatherers, since it begins the harvest with old and worn-out workers. This is exactly what often happens unless the beekeeper is alert and provides conditions such that brood rearing is not restricted during this period. In the clover belt, for example, it frequently happens that there is a scarcity of nectar during the period when the workers for the harvest should be reared and, unless the colonies are abundantly supplied with stores, brood rearing is greatly restricted. This may to some extent justify the saying among beekeepers that if the early flowers yield well the season

will be good. The progressive beekeeper, however, provides conditions favorable to brood rearing even though the early flowers fail to yield nectar. It is therefore highly important (1) that each colony be in a normal condition at a period six or eight weeks previous to the honey flow, and (2) that brood rearing be at its maximum for the entire period of six or eight weeks during which the brood is reared to produce workers available for the honey flow.

BUILDING UP THE COLONY IN THE EARLY SPRING.

The condition of the colonies in the early spring depends upon many factors not all of which are under the control of the beekeeper. In the white-clover belt for instance, where the honey flow comes early, a large percentage of strong colonies in early spring means of course that they have wintered well, which in turn is largely dependent upon proper conditions the previous late summer and autumn. The manipulations having for their purpose the rapid upbuilding of the colony may therefore have their beginning at or even before the close of the honey flow of the previous year, including late summer and fall management and wintering. Good queens, preferably young, with enough room for breeding purposes and a supply of stores during the previous late summer and autumn are among the factors favoring good wintering. During the winter the central idea is the conservation of the energy of the bees, the complex details of which can not be presented in this paper.

The rapidity with which the colonies build up in early spring depends upon a number of conditions, some of which are: (1) The number and vitality of the workers; (2) the age and fecundity of the queen; (3) the supply and location of stores within the hive; (4) weather conditions; (5) the supply of new pollen, nectar, and water; (6) the conservation of heat within the brood nest; (7) the race of bees; (8) the character of the brood combs, etc. Most of these conditions are to a great extent within the control of the beekeeper. By supplying each colony with a young queen the previous autumn, or at least supplanting all undesirable ones, a greater number of young and vigorous workers are reared late in the season, which usually means greater vitality and numbers the next spring. Young queens reared the previous summer or autumn should be in prime condition the next spring. If to this combination is added an abundance of stores within the hives, brood rearing should progress rapidly, even in spite of adverse weather conditions. It is now the general practice among beekeepers to supply enough stores the previous autumn not only for winter stores but for brood-rearing purposes the next spring. Since the amount consumed during the

winter varies considerably with different colonies, an early examination to determine the amount of stores may be necessary. Under some conditions it may be found profitable to stimulate brood rearing early in the spring by slowly feeding diluted sugar sirup to each colony, by spreading brood, or by doing both, but any very early stimulation of this kind should be used with caution. Among extensive beekeepers the tendency is decidedly toward letting the bees alone until the weather is more settled, simply making sure that they have sufficient stores. The apiary should, if possible, be so located that the bees may have access to water without the necessity of exposure of a long flight during bad weather. In localities that do not furnish natural pollen, it may be necessary to feed an artificial substitute, such as rye meal. A good hive that will conserve the heat of the cluster is also a great help in early brood rearing. Some beekeepers who winter their colonies in the cellar in single-walled hives find it profitable to give them some additional protection after they have been removed from the cellar. In the northern States double-walled hives are especially advantageous during the spring. A protected location for the apiary in some instances makes a great difference in early brood rearing. Some races breed up more rapidly in the spring than others. The Italians are somewhat conservative in this respect, but have so many excellent traits that they are generally used in this country. In localities having intermittent honey flows Italian bees may not give the best results because of their tendency to restrict brood rearing during the honey flow by crowding the queen and to curtail the production of brood during a scarcity of nectar. Drone comb within the brood nest in early spring is a decided barrier to rapid brood rearing. Many brood combs considered by the average beekeeper to be perfect contain, especially in the upper portion, a large percentage of cells which can not be used for rearing worker brood because of imperfections in shape and size due to the stretching of this portion of the combs during hot weather. This suggests the advisability of the use of a heavier grade of foundation or some method of using vertical wires or wooden splints in the upper half of the sheet of foundation.

THE PRODUCTION OF GATHERING BEES.

During the six or eight weeks just preceding the honey flow every colony should be encouraged to rear the greatest possible amount of brood. Brood rearing during this period is often restricted by insufficient stores or by insufficient room. It is therefore of great importance that both stores and available brood-rearing space be supplied in abundance. If stimulative feeding or spreading the brood is practiced, this is the time it should be done.

Providing Sufficient Stores.

If feeding is not practiced during this critical period, the beekeeper should see that each colony is at all times supplied with a reserve of stores, for surprisingly large quantities are consumed when brood rearing is going on rapidly. If any colonies should run short, brood rearing will be carried on sparingly and the colony so severely crippled that it may not recover its strength until after the honey flow is over.

Whether stimulative feeding or supplying each colony with an abundance of reserve stores is the more profitable depends upon circumstances and must be decided by each beekeeper for his own conditions. Stimulative feeding, if properly done, will undoubtedly result in the rearing of more bees for the harvest. When the beekeeper is operating several apiaries and must travel some distance to reach them the labor involved is considerable, and the question to be decided is whether this labor would yield greater returns if expended in stimulative feeding or in operating a larger number of colonies. If the brood chamber is large and well provisioned or if the flowers furnish some nectar in early spring the colonies may have sufficient stores for this period of heavy brood rearing. Some beekeepers save combs of honey of the previous year to supply food for this period. This is one of the most convenient and satisfactory methods of feeding.

Providing Available Brood-Rearing Space.

There should be no restriction whatever in the room for brood rearing up to the time of putting on the supers, just previous to the honey flow, for a crowded brood nest at this time tends to diminish the number of workers available for the honey flow as well as to encourage swarming.

If the space for brood rearing should be restricted by too much early honey in the brood chamber some of the heaviest combs should be removed and empty ones given instead, or an extra brood chamber containing empty combs may be given. In localities where considerable early honey is gathered the brood chamber may be kept almost free of honey by placing an extracting super over each colony at the beginning of such a flow. This super should not be removed until the comb-honey supers are given, for the honey may be needed later in brood rearing.

Should the brood nest be restricted by a small brood chamber the colonies may be equalized by removing some frames of brood from the stronger colonies, exchanging them for empty combs taken from weaker colonies, or another brood chamber filled with empty combs may be given, thus building the colonies up individually.

The former method has the following advantages: (1) After being built up to approximately the same strength, most of the colonies will be ready for a given manipulation at the same time, thus facilitating the work. (2) It requires a smaller stock of extra brood chambers and combs, at least previous to the honey flow. (3) The brood is in a more compact form, which is a very desirable condition in comb-honey production. (4) When properly done, the total number of young bees reared in a given time is probably considerably greater, owing to the fact that none of the colonies is strong beyond the capacity of the queen, the workers of the entire apiary being so distributed that all the queens are utilized to the best possible advantage. (5) When the honey flow begins the colonies are ready for the supers without additional manipulation, such as removing extra brood chambers, sorting combs of brood, etc. In equalizing colonies combs of hatching brood with the adhering workers, *without the queen*, are usually drawn from the strongest colonies and given to colonies less strong, but *never to very weak colonies*. The weakest colonies are left until the last, then built up quickly, provided there is time enough to have all the hives well filled with brood. If this is not possible the very weak colonies can more profitably be used for purposes other than comb-honey production. Another plan of equalizing is that of shaking bees from combs taken from strong colonies at the entrance of colonies less strong. The older bees at once take wing and return to their hives, while the younger bees enter the weaker colony. The operator must, of course, be sure that the queen is not on the comb thus shaken.

Some of the advantages of building up the colonies as individuals are: (1) The labor required is considerably less, fewer visits being required, so that this method is particularly adapted to out-apiary conditions. (2) It is possible to determine with much greater accuracy which colonies show the most desirable traits for breeding purposes. (3) It can be more safely practiced if brood diseases are imminent.

SUMMARY.

(1) The workers that take part in storing a crop of honey from any given honey flow are usually those reared within the period of six or eight weeks just preceding the honey flow. The workers reared previous to this period are too old to be of much value as gatherers, while those reared after this period mature after the flow has ceased.

(2) It is necessary that the beekeeper know what plants are likely to furnish the surplus honey and their approximate period of bloom, so that he can determine the limits of the heavy brood-rearing period in order to secure the largest possible working force for the honey flow.

(3) Colonies should be in a normal condition at the beginning of this period. (*a*) If the surplus is from an early flow, this normal condition can be obtained only by proper management the previous late summer and autumn, together with good wintering. Good queens, preferably young, together with sufficient room for brood rearing and winter stores, are important conditions during late summer and autumn. (*b*) Stores and protection are important factors in early brood rearing. (*c*) The character of the brood combs and the race of bees each have some influence upon brood rearing.

(4) During the time that workers for the harvest should be reared brood rearing should be constantly accelerated.

(5) Brood rearing is often restricted during this period (*a*) because of limited stores and (*b*) because of limited room in the brood chamber.

Using Available Workers to Best Advantage During the Honey Flow.

Brood rearing, which is of primary importance during the preceding period, becomes of secondary consideration at about the beginning of the honey flow, because this is nearing the limit beyond which time the resulting bees develop too late to take part in gathering and storing the crop of honey. At this time, therefore, there is a radical change in purpose of the manipulations. Instead of continuing the expansion of the brood chamber, the policy of the beekeeper should now be rather a concentration of the workers and brood. There is perhaps a limit to the number of workers that can be profitably kept in a single hive and set of supers, but this limit is seldom reached, the usual mistake being in having too few. Each colony should have its brood chamber well filled with brood in a compact form and be so crowded with young and vigorous workers that they will immediately occupy the supers when the honey flow actually begins. The brood chamber of colonies occupying more than one hive body should at this time be reduced to one, any extra brood being used in colonies having less than one brood chamber full of brood. After this operation, should there still be some colonies left with the brood chamber but partly filled with brood, they should be filled with combs of brood and adhering bees (without the queen) drawn from some colony or colonies too weak to work well in comb-honey supers.

It may be advisable to unite the weaker colonies in order to secure the proper strength for the best work. This massing of the workers in strong colonies, so essential to the production of a fancy grade of comb honey, renders necessary extremely careful and skillful management, since the efforts of the beekeeper may still be nullified in either of two ways: (1) The bees may divide their forces by swarming into two or more parts, neither of which would be ready to work in the supers until the season is much advanced or perhaps closed

entirely, or (2) being balked in their desire to swarm or from lack of convenient storage space, etc., they may do very poor work even during a good honey flow simply because the conditions of the colony are such that the storing instinct is not dominant. *To bring about the best results in comb honey, the entire working force of each colony must be kept undivided and the means employed in doing so must be such that the storing instinct remains dominant throughout any given honey flow.* Any increase made before or during the flow [1] is made at the expense of the surplus honey unless it be made with brood that would emerge too late for the young bees to be of use during the honey flow (p. 31). In general, however, increase may be made at much less expense by setting aside some of the colonies for that purpose. To keep the forces together and satisfied, with the storing instinct dominant during a good flow, is the most difficult problem with which the producer of comb honey must deal.

Swarming.

All colonies do not behave alike as to swarming. (1) There are certain colonies that go through the season with apparently no thought of swarming. Such colonies do the very best work in the supers, and their number can be increased by skillful management. (2) Other colonies start queen cells preparatory to swarming, but can be persuaded to give it up by such mild measures as destroying the queen cells and perhaps removing a few frames of brood. (3) Certain colonies are determined to swarm and, unless the flow ceases, nothing short of swarming or some radical manipulation will satisfy them. (4) A certain percentage of queens fail during the honey flow and swarming may occur in connection with the supersedure. Such colonies usually do very poor work in comb-honey supers.

The beekeeper can do much (1) toward increasing the percentage in the first group and discouraging those of the second—*preventive measures*, and (2) toward making the most of the colonies under the third and fourth groups—*control measures*.

PREVENTIVE MEASURES.

Some effort has been made toward the final elimination of swarming by breeding from colonies showing the least disposition to swarm. Although after years of selection bees continue to swarm when conditions are favorable, many practical beekeepers testify to having greatly reduced the percentage of swarming colonies by years of careful selection and breeding. It would certainly seem advisable to

[1] In localities where the main honey flow is so late that colonies may be divided long enough before the flow so that both colonies may be built up to proper strength in time to take advantage of it, of course increase previous to the flow would be advisable. This condition is rare in comb-honey localities.

replace the queens of all colonies which persist in swarming with young queens reared from colonies less inclined to swarm. The swarming problem has also been attacked from the standpoint of the hive and mechanical attachments, finally resulting in the invention of a "nonswarming" hive. More attention has, however, been paid to the prevention and control of swarming by manipulation than along either of the other lines, probably because proper manipulation gives immediate results and is now available as a means of preventing the losses due to swarming. The success in swarm control attained by the best beekeepers is a result of some effort along all three of the above lines at the same time.

Among the manipulations that tend to discourage swarming are (1) the introduction of young queens (preferably reared from selected stock); (2) an abundance of empty comb in the brood chamber at all times previous to the honey flow; (3) prompt work in the supers at the beginning of the flow induced by using "bait sections" or extracting combs in the first super given, thus tiding the colony over one of the critical periods; (4) a judicious manipulation of the supers during the honey flow (p. 41); (5) the use of more nearly perfect worker combs in the brood chamber, since drone comb and imperfect cells (p. 22) have the effect of contracting the brood chamber, thus bringing about a crowded condition; (6) an abundance of ventilation during the honey flow, obtained by means of a large entrance or by raising the hive above the bottom board by means of small blocks; (7) protection of the hive from direct rays of the sun during the hottest portion of the day by some such means as a double cover or shade board; (8) the removal of one or two frames of brood and the substitution therefor of empty combs or sheets of foundation; (9) the destruction of all queen cells provided they contain only eggs or very small larvæ.

If queen cells are well advanced, their destruction usually has little or no effect as a swarm preventive measure. While destroying queen cells in their early stages can not be relied upon as a preventive of swarming, beekeepers who practice examining the brood chambers once a week for queen cells during the swarming season are usually surprised at the number of colonies that can be induced to give up swarming and turn their attention to storing in this way. Such a result at least partly compensates for the large amount of labor required for these weekly examinations.

CONTROL MEASURES.

After having taken all precautions as to preventive measures there will still be some colonies that will attempt to swarm when producing comb honey. During poor seasons of course the percentage may be

quite low, but during good seasons the conditions are sometimes such that a majority of the colonies may make an effort to swarm. Swarming colonies, however, may be controlled in such a manner that practically as much surplus honey is secured as if the colony made no attempt to swarm. If but a single apiary is being operated and the beekeeper is present during the swarming season, the bees may be permitted to swarm naturally without loss to the beekeeper; but if several apiaries are being operated, it is more economical to employ some method by which swarming may be controlled by visiting each apiary at given intervals during the swarming season, rather than to have an attendant at each.

Control of Natural Swarms.

Natural swarms may be managed (1) by allowing them to cluster naturally, then hiving them in the ordinary manner; (2) by the clipped queen method; (3) by the use of queen traps (fig. 13; see Farmers' Bulletin No. 447, pp. 29–30); or (4) by use of the swarm catcher.[1]

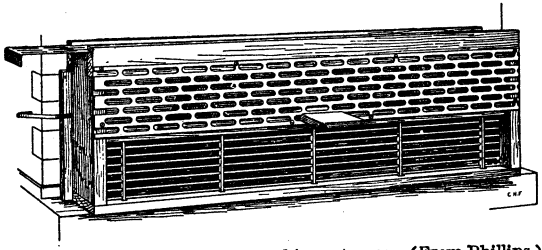

FIG. 13.—Drone and queen trap on hive entrance. (From Phillips.)

To keep the forces together (1) the swarm without the queen may be returned to its hive, the queen cells destroyed a week later, and the colony afterwards requeened (p. 36); or (2) the brood may be removed from the hive while the swarm is out, after which the swarm with the queen is returned. The former method is useful under some conditions (p. 37), but the latter is the one usually preferred.

When the swarm is hived back without the brood on its old location in this manner, the colony does not lose any of its flying bees and is back at work with renewed energy in the same set of supers it was but a few minutes before so eagerly deserting. Instead of removing the combs from the brood chamber the usual practice is the removal of the entire brood chamber and the substitution of another whose external appearance is the same. This method of swarm management keeps the bees, queen, and supers together and is one of the most satisfactory known. It is not, however, adapted to out-apiaries or any apiaries not having an attendant, and requires considerable time in watching for and hiving swarms.

[1] This is simply a wire-cloth cage large enough to be set over the hive or be fitted over the entrance. If the attendant is provided with a number of these catchers he can avoid the usual confusion ordinarily occurring when several swarms issue at about the same time. After being caught in this manner the swarms may be hived at the convenience of the beekeeper.

USING THE REMOVED BROOD TO BEST ADVANTAGE.

The disposition of the brood that is left when a swarm issues should be such that (1) no "after-swarms" (swarms resulting from the emergence of a plurality of virgin queens) are permitted to issue and (2) that the emerging workers may be used to the best advantage.

"After-swarming" may be prevented by (1) breaking up the parent colony before any of the young queens emerge, using the unhatched brood elsewhere, (2) by destroying all queen cells but one before any young queens emerge, or (3) by greatly reducing the population of the parent colony[1] just before the young queens emerge.

FIG. 14.—Colony before swarming; supers in place. (Original.)

If swarming occurs at a time when the resulting young bees can take part in gathering and storing the crop of honey, the usual practice is to allow the brood to emerge in a separate hive and later to add these young bees to the colony from which it was taken. Under such circumstances this reenforcement of the swarm is especially desirable, since otherwise its forces are constantly diminishing during the 21 days (the time required for worker brood to develop) immediately following the removal of all its brood. The brood, however, may be used anywhere in the apiary and should be placed where the resulting bees will be most needed. The plans given below make use of at least a part of the emerging bees in reenforcing the swarm from which the brood was taken.

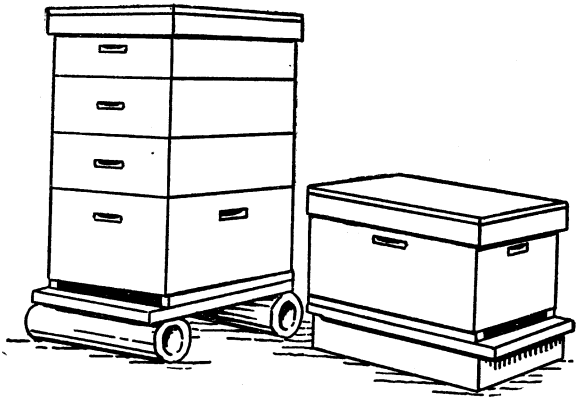

FIG. 15.—Brood placed in hive turned 90 degrees from old entrance. (Original.)

When hiving natural swarms on the old location as suggested above, the old brood chamber is provided with a bottom and cover and set aside, usually with its entrance turned away about 90° from its former position (figs. 14, 15). This

[1] The term "parent colony" applies to the one in the hive from which the swarm issues and is in common use, though the correctness of the term is questionable.

is to prevent any field bees returning to the parent colony. A day or so later it is turned about 45° toward its former position (fig. 16) and as soon as the bees have this location of the entrance well marked the hive is placed parallel to the hive on the old stand (fig. 17). So far as the bees returning from the field are concerned, these two colonies are now on the same stand.

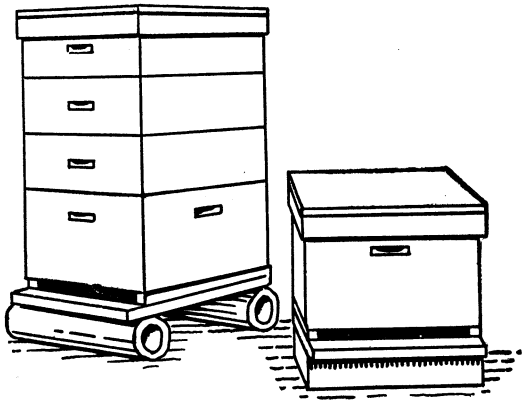

FIG. 16.—Hive with brood turned back to 45 degrees from old entrance. (Original.)

The further disposition of the remnant of the brood and young bees may be by any one of the following methods: (1) One week after the swarm issues, or just before the parent colony would cast a second or "after-swarm," it may, when the bees are well at work in the fields, be removed and given a new location. This throws the entire flying force into the colony having the supers, where they are of greatest service, and so depletes the other colony of its flying bees just when the young queens are emerging that "after-swarming" is usually prevented. (2) Before moving it away the parent colony may be more thoroughly depleted of its young bees by shaking most of them from their combs, adding them of course to the colony with the supers. The comb containing the finest queen cells should not be shaken, since to do so will probably injure the immature queens. Two or three frames should be left with their adhering bees in order that the parent colony will still contain enough workers to care for the remaining unemerged brood. (3) Instead of moving the parent colony away as in (1) above, the bees may all be added to the swarm by shaking them from their combs, and the combs then distributed among nuclei previously prepared. By successive additions of frames of brood these nuclei are finally built up into full colonies and "after-swarming"

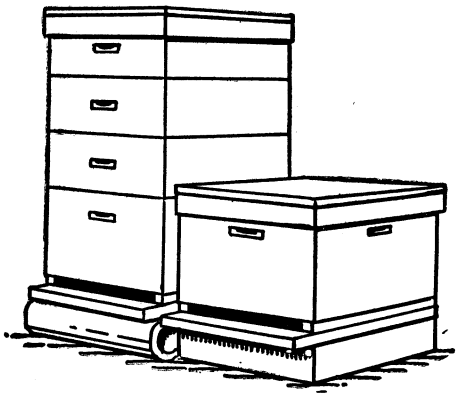

FIG. 17.—Hive with brood turned parallel to old entrance. (Original.)

is prevented. (4) Instead of giving the parent colony a new location, as in (1) above, it may be shifted to the opposite side of the swarm on the old stand (fig. 18) and by thus shifting it from one side to the other at intervals of several days the young bees as they hatch and learn to fly will finally all be added to the colony with the supers. Few beekeepers, however, go to this extreme, as the season usually closes before the latest emerging young bees are thus transferred to the colony with the supers and these later-emerging bees may be used for increase at little if any expense in surplus honey. (5) If increase is not desired, the bees may be added to the swarm on the old stand as before, and after 10 or 15 days the combs of the parent colony still containing some unhatched brood may be used on which to hive another swarm. Before being used for this purpose the bees are of course shaken from these combs and added as before to the swarm on the old stand. (6) If the honey flow is of long duration or conditions otherwise such that the storing colony may prepare to swarm again, the brood chamber of the parent colony may be left by the side of the swarm (fig. 18) until the young queen begins to lay, then restored to its original position on the old stand and the supers transferred to it. The brood chamber containing the old queen is moved to one side, its flying bees thus induced to enter the hive containing the young queen. The two colonies may afterwards be united or the one containing the old queen may finally be moved to a new location for increase. If, when using this plan, a virgin queen or a ripe queen cell is given the parent colony just after the swarm issues, this colony is ready to be restored to its original position on the old stand about a week earlier than if left to requeen itself.

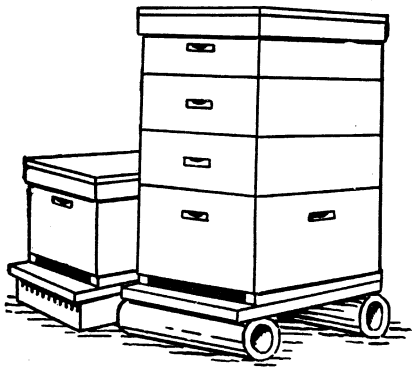

FIG. 18.—Hive with brood placed on other side of old entrance. (Original.)

In case the emerging bees are not to be added to the storing colony the brood and young bees may be used in one of the following ways: (1) They may be used immediately after the swarm issues to build up such colonies as are not strong enough to work in the supers or to build up previously prepared nuclei, as in (3) above. Before being used in these ways the adhering bees are usually added to the swarm. (2) The parent colony may be placed at once on a new stand and given a laying or virgin queen. To allow such a colony to requeen itself usually results in its casting an "after swarm," since it becomes quite

populous again before the young queens emerge. This plan does not make immediate use of the emerging bees but may be useful under some conditions. (3) If the honey flow is of long duration or is followed closely by a second, two parent colonies, as in (2) above, may be placed upon the same stand, one of which is given a queen but with the queen cells destroyed in the other. After two or three weeks the bees may be shaken from the queenless colony in with the queen-right one. Such colonies are in excellent condition for rapid work in the supers.

WHAT TO USE IN THE BROOD CHAMBER WHEN HIVING SWARMS.

(1) The use of narrow strips of foundation 1 inch or less in width in the brood chamber offers some advantages. (*a*) When the brood chamber contains only these narrow "starters" and supers of partly filled sections are transferred from the parent colony to the new swarm at the time of hiving, there being no cells below in which to store the honey, it is taken to the supers. Under these conditions work in the brood chamber goes on slowly, the work of the colony being largely in the supers. (*b*) Colonies that are thus required to construct a set of new combs in the brood chamber and that are supplied with sufficent storage room seldom attempt to swarm again during the same season, even though the flow be of long duration. (*c*) The treatment of brood diseases may be combined with swarm control. (See Farmers' Bulletin No. 442, p. 14.) The greatest objection to their use is in the excessive amount of drone comb usually built when anything less than full sheets of foundation are used, especially if the queen is old or the brood chamber large in proportion to the size of the swarm.

(2) The use of full sheets of foundation in the brood frames has the decided advantage of resulting in straight combs having the maximum number of cells of the worker size, but is more expensive than the narrow strips and allows a more rapid building of comb in the brood chamber, which under some conditions is considered a disadvantage.

(3) The exclusive use of either narrow strips or full sheets of foundation in the brood chamber when hiving swarms necessitates the use for a short time of a queen excluder (fig. 2) if the supers are transferred from the parent colony to the swarm at the time of hiving, since otherwise the queen would probably enter the sections and a brood nest be established there. To avoid the use of queen excluders for this purpose, one or more empty combs may be used in each brood chamber, the remaining frames containing full sheets of foundation. This empty comb also serves as a storage place for pollen that may be gathered before the other combs of the brood chamber are constructed. Otherwise this pollen may be stored in

the sections (p. 46). It is also probable that fewer colonies will "swarm out" or desert their hives if hived in a brood chamber containing one or more empty combs than if foundation only is used. A disadvantage of this plan is that the cells near the top bar of the comb may be so elongated as to interfere with the complete drawing out of the foundation in the adjacent frame. Empty combs can not well be used in connection with narrow strips of foundation, since their use favors the construction of drone comb.

(4) Empty combs are sometimes used with the idea of saving the bees the work of constructing a new set of combs. Under same conditions this is false economy and gives poorer results than starters or foundation. With very strong colonies, or with the brood chamber contracted to five or six frames, empty combs in the brood chamber may give good results. Medium colonies on a full set of empty combs are inclined to store the honey in the brood chamber and neglect the supers.

(5) Combs of honey are sometimes used on which to hive swarms. In some instances the beekeeper uses frames of foundation or empty combs above the brood chamber previous to and during the first few days of the honey flow for the purpose of discouraging swarming and afterwards uses these partly filled combs on which to hive swarms. In order to make room for the queen, this honey is rapidly carried above, and stored in the sections.

(6) Combs of sealed brood in which no eggs have been laid during the previous 10 days or 2 weeks may be used. Such combs are usually available toward the close of the swarming season from colonies that have swarmed 10 days or 2 weeks before. This plan is especially desirable when the beekeeper runs short of hives during the swarming season. In some localities, however, the character of the flow is such that the colonies may later again prepare to swarm when hived on either empty combs or combs of sealed brood.

EXTREME CONTRACTION OF THE BROOD CHAMBER WHEN HIVING SWARMS.

Some beekeepers contract the brood chamber, when hiving swarms, to five or six frames, the remaining space being filled by means of division boards or "dummies." This reduction in the capacity of the brood chamber results in practically all the honey being stored in the supers and also restricts brood rearing at a time when the resulting bees develop too late to become gatherers. This is especially adaptable to locations furnishing an early flow of white honey followed by a later flow of darker honey. The white or more marketable honey is stored in the supers and later the brood chamber is expanded and provisioned for winter with the less desirable honey.

Some beekeepers accomplish a somewhat similar result by hiving two swarms together in a single hive body.

When practicing contraction it is best to give the full amount of room at the time of hiving the swarm and to reduce the space three or four days later, as otherwise the bees are apt to "swarm out" because of their cramped quarters. Since contraction of the brood chamber is but a temporary expedient, it should not be continued beyond the time that its use is of advantage. If there should be a later honey flow, the brood chamber should be expanded in time to rear the bees for it. In any event, contraction should not continue so long as to interfere with securing the proper conditions of the colonies for winter (p. 21). Frames of foundation, empty combs, frames of brood or honey may be used to complete the set of combs when expanding the brood chamber, and these are usually given just before or at the close of the honey flow. Contraction of the brood chamber to less than one hive body, except in hiving swarms, is not usually advisable.

Swarm Control by Manipulation.

Swarm control by manipulation enables the beekeeper to operate a series of apiaries by visiting each at certain intervals, thus eliminating the necessity of an attendant in each apiary during the swarming season. The fact that bees usually, by the construction of queen cells, indicate about a week in advance their intention to swarm, enables the beekeeper to control swarming by examining each colony once a week during the swarming period and forestalling the colonies that are making preparations to swarm. It is also possible to manipulate all the colonies before any swarming occurs so that most of them go through the honey flow without swarming, thus eliminating the weekly examinations.

Any manipulation for swarm control, whether applied after the colony has acquired the "swarming fever" or applied to all colonies alike previous to the swarming season, is based upon the single principle—*a temporary disturbance in the continuity of the daily emergence of brood.* This disturbance should occur just previous to or during the swarming season. In natural swarming the brood and the swarm are separated, the swarm being without hatching brood during a period of three weeks. The brood from which the swarm came may be allowed to emerge in a separate hive and the resulting bees may then be returned to the swarm (p. 29). In this way the swarming instinct is satisfied, at least temporarily, without materially decreasing the population of the colony. The beekeeper may anticipate swarming by removing the brood from the hive, allowing it to emerge in a separate hive and finally returning these young bees to

the colony in the same manner as is done with the natural swarm. Under the same conditions the subsequent behavior of a colony treated in this way is similar to that of a natural swarm. In either case there has been a break in the continuity of the emergence of young bees in the hive during a period of three weeks.

Instead of hiving a natural swarm upon empty combs or frames of foundation, combs of emerging brood (without queen cells) taken from a colony that has been queenless during a period of 10 to 15 days may be used (p. 33) and a similar condition may be had without swarming by removing all of the brood and substituting such combs of emerging brood, thus at least temporarily avoiding swarming. In these cases there is a break of 10 to 15 days in the continuity of the daily emergence of bees.

A similar interruption of brood rearing may be accomplished by removing the queen from the hive or caging her within the hive during a period of 10 days or 2 weeks, then returning her to the combs. In this case no queen cells must of course be allowed to mature. A condition similar to this may be obtained without removing the queen by dividing the brood chamber into two parts with queen-excluding metal, for a period of 10 to 15 days. The brood from the division containing the queen is then removed and the bees, together with the queen, shaken into the other (queenless) division, the queen cells if any being first destroyed. The brood thus removed may later be returned to the colony in the form of young bees in the usual manner (p. 29). Even the destruction of the sealed brood by uncapping it has been advised as a means of swarm control. This gives a period of about 12 days during which few or no young bees emerge.

These methods are illustrative of the principle employed in the various methods of control by manipulation, which may be classified under three general headings: (1) Taking the queen from the hive. (2) Taking the brood from the hive. (3) Separating the queen and brood within the hive.

The following methods of swarm control are given for the purpose of illustrating the various types of control by manipulation. It is not to be understood that all the methods given are equally adaptable to any locality or season, but it is hoped that, presented in this way, the beekeeper may more readily see the principle underlying each plan as well as the basic principle underlying all the plans and thereby be better enabled to elaborate a system of control to meet his particular requirements.

TAKING THE QUEEN FROM THE HIVE.

The temporary removal of the queen from the colony for the required time (p. 36) and the return of the same queen is a method which has been used in swarm control. Of course, no queen cells

should be permitted to develop in the meantime. Such colonies may prepare to swarm again, especially if the period of queenlessness is not more than 10 days. The method is a valuable one, however, and may be used at any time during the season on colonies making preparations to swarm.

Dequeening in connection with requeening.—Requeening each colony with a young queen early in the season may greatly reduce the percentage of colonies that attempt to swarm but can not be relied upon as a method of complete control since during a good and prolonged honey flow quite a number of such colonies prepare to swarm. If each colony is requeened with a young queen at the beginning of the honey flow, *after having been queenless for 10 or 15 days*, there will probably be very little if any swarming during an ordinary season. This method is not in general use among beekeepers, largely because of the difficulty in so timing the operation that there will be no loss. The following are illustrative of the various adaptations of requeening in connection with a period of no brood rearing.

(1) Just previous to the honey flow and at about the time that heavy brood rearing is no longer desirable, remove the queen from each colony. (*a*) Eight or ten days later destroy all queen cells but one and allow the colony to requeen itself, or (*b*) destroy *all* queen cells 8 or 10 days after removing the queen, then after 3 to 6 days supply each colony with a "ripe" queen cell (one in which the queen is ready to emerge), a virgin queen, or a young laying queen. It is usually desirable that the interval of queenlessness be as short as possible without defeating its purpose. Some beekeepers give a young laying queen 10 days after removing the old one, or a virgin or ripe cell considerably earlier, sometimes even at the time the old queen is removed, while others prefer a period of at least 14 days before giving either a laying or a virgin queen. However, colonies with virgin queens sometimes swarm even though no other queen cells or larvæ from which to rear a queen are present. Another objection to the use of queen cells or virgin queens for this purpose is that some of the queens fail to emerge and some virgin queens fail to mate, thus leaving the colony hopelessly queenless. For these reasons, some prefer to have the young queens mate and begin to lay in "nuclei" (very small colonies) before introducing[1] them in the strong colonies. This method may be used for the entire apiary at the beginning of the honey flow or it may be applied only to those colonies making preparations to swarm.

(2) Use two hive bodies as a brood chamber before the honey flow, uniting if necessary to secure strong colonies. At the beginning of the honey flow divide each colony, leaving the field bees and most of

[1] These young laying queens may be introduced into the colony by the ordinary indirect or caging method (Farmers' Bulletin No. 447, p. 44) or together with a comb of brood and adhering bees from the nucleus from which she was mated.

the brood on the old stand in one hive body, placing the queen, remaining brood, and enough bees to care for it in the other hive body which is set beside the first. The supers are of course given to the queenless colony on the old stand, which after the proper interval of queenlessness is allowed to requeen itself or is requeened by the beekeeper as in (1) above. The colony containing the old queen may be used to strengthen the storing colony by shifting its position from one side of it to the other (p. 31), or used for increase.

(3) Ten days before the honey flow is expected to begin, put most of the brood into a single hive body, on this a queen excluder, and over this a second hive body with a frame of brood and the queen, the other combs of this set being empty except perhaps a little brood and honey. Nine or ten days later remove the upper story, supply it with a bottom board, and place it close beside the original hive. Destroy queen cells if any are present in the queenless portion which remains on the old stand, give a ripe queen cell, virgin queen, or a young laying queen, and put on the supers. The brood chamber containing the old queen may be used to make increase or its flying bees may be united with the storing colony (p. 31).

By any of these methods there is a break of 10 to 15 days in the continuity of brood emergence in the brood chamber left on the old stand and the colonies are requeened with young queens—each a strong factor in swarm control and when combined should with rare exceptions result in no swarming.

REMOVING THE BROOD FROM THE HIVE.

Since removing the brood brings about conditions quite similar to that of natural swarming (p. 28), such a management of the colonies is practically identical with that of natural swarming. The use of the brood that is removed (p. 29), the question of what should be used in the brood chamber instead of the removed brood (p. 32), the contraction of the brood chamber (p. 33), etc., have been discussed under natural swarming and need not be repeated here. While some of the plans using this principle may be applied to all the colonies in the apiary before swarming actually begins, the usual practice is to apply them only to such colonies as are making preparations to swarm. It should not be used on weak colonies, on colonies having a small percentage of sealed and emerging brood and few young bees, on colonies in which the queen is failing, or on any colonies during a very poor season. Under any of these conditions it is usually better to discourage swarming by destroying queen cells (p. 27), by removing one or two frames of brood, or, if some control measure is finally necessary, by requeening such colonies after an interval of queenlessness. On the other hand, for strong colonies having a high percentage of sealed and emerging brood and a good queen the method

usually gives excellent results, since by its use the workers, queen, and supers are kept together during the flow. The following are some of the various plans employing this principle of swarm control:

(1) Find the queen and put the comb on which she is found to one side, then shake the bees from most of the other combs into or in front of their hive. As the combs of brood are removed put frames containing either narrow strips or full sheets of foundation or combs into the hive and replace the supers. When most of the shaken bees are in the hive, place the queen among them. Put all the brood and the few bees remaining thereon into another hive close beside the shaken colony (fig. 17). Enough bees should be left on the combs of brood to care for it; usually two combs are not shaken at all, but placed in the other hive with all the adhering bees. For further disposition of the brood see page 29.

(2) In order to avoid the trouble of finding the queen, the above plan may be varied by shaking and brushing *all* the bees from the combs so as to be sure that the queen is among them. In this case the brood may be utilized by one of the following plans: (*a*) Use it to build up weaker colonies (p. 31) or (*b*) place it in a hive body over a queen excluder on top of the forced swarm or some colony not being used for comb-honey production that can spare enough bees to care for it. In a short time bees will pass through the excluder and cover the brood, after which the hive body containing it is removed, supplied with a cover and bottom board, and placed at one side of the forced swarm so that the emerging bees may later be added to the swarm. Or (*c*) after the shaking is complete, remove the forced swarm and put the hive body containing the brood temporarily back on the original stand to induce field bees to enter it. Then in the evening set it aside and restore the swarm to its position on the old stand. These field bees will be able to prevent the brood being chilled during the night but in returning from the fields the next day will enter the hive on the old stand. In the meantime enough young bees will have emerged to care for the brood.

(3) Removing all the brood and substituting frames containing narrow strips or full sheets of foundation sometimes results in the colony swarming out the next day. This may be avoided by removing the brood in two installments with an interval of a few days between the two operations. When the brood is not all removed, full sheets of foundation or empty combs should be used or an excessive amount of drone comb will be built.

With sectional hives, stand the brood chamber on end, smoke the bees out of the lower section, and remove it. Destroy queen cells in the upper hive section. These will almost universally be found projecting into the space between the two sections of the brood chamber.

Substitute a new hive section containing empty combs or foundation for the removed section. After a few days remove the supers, smoke the bees out of the upper section, remove it, and add it to the section that was removed before, which at the time of its removal was given the usual position beside the colony (fig. 17).

(4) Use two hive bodies as a brood chamber throughout the year except during the honey flow. Have both as well filled with brood as possible previous to the flow. About 10 days before the honey flow is expected to begin, insert a queen-excluding honey board (fig. 2) between the two hive bodies. The queen is now confined to a single one of the hive bodies. After 10 days transfer the queen [1] to the other hive body placed on the old stand and put on the supers. Remove the hive body in which the queen has been confined to one side of the colony on the old stand and supply it with a ripe queen cell (in a protector) or a virgin queen. When the young queen begins to lay, exchange places with the two hive bodies so that the one containing the young queen now becomes the storing colony, giving it the supers and field bees. Shift the hive containing the old queen from one side to the other of the colony on the old stand about once a week, so that the entire flying force of both are at work in the hive with the supers (p. 31). At the close of the honey flow the old queen may be killed unless she is especially valuable and the two divisions may be reunited. The period of 10 days during which no eggs are laid in the hive body used by the storing colony at the beginning of the honey flow should delay swarming at least until the young queen begins to lay. When the other hive body with the young queen is substituted, it has had a similar period of no egg laying in addition to having a young laying queen, making a desirable combination.

Mechanical devices.—A number of mechanical devices have been described for shifting bees from one brood chamber to another. These permit the bees to leave the hive when going to the fields and are so arranged that the returning bees are led to enter the new brood chamber. This is accomplished by means of switches in the bottom board or by a chute or tube so attached that the entrance to the old brood chamber is closed, allowing exit only through the tube which opens near the entrance of the new brood chamber. In either case the hives are so arranged that the bees returning from the field readily enter the new brood chamber. The queen is found and together with a comb of brood and adhering bees is put into the new brood chamber, and the supers are transferred from the old to

[1] It is not necessary to find the queen, since the presence of unsealed brood indicates in which hive body she is confined. She may be transferred to the other hive body by shaking all the bees from the combs she is known to occupy in with the bees of the other hive body. In this case some bees are returned to the shaken combs (p. 38) before this brood is set aside, to prevent its being chilled.

the new brood chamber. The young bees as they learn to fly are added to the swarm by the same device. Otherwise the manipulation is the same as the other methods described.

SEPARATING THE QUEEN AND BROOD WITHIN THE HIVE.

In some swarm-control methods neither the queen nor the brood is removed from the hive, but these are temporarily separated within the hive. These methods are ordinarily used only on colonies making preparations to swarm and are practically equivalent to the dequeening plan. The following methods make use of this principle of swarm control:

(1) The queen may be placed in a wire-cloth cage within the hive or may be confined to a small comb surface within the brood chamber by means of queen-excluding zinc. No queen cells are permitted to mature, and the queen is liberated after 10 to 15 days.

(2) The queen together with a comb containing a small amount of brood is placed in a lower hive body containing no other frames or combs. After destroying all queen cells the brood is placed in a second hive body, the two hive bodies being separated by a queen-excluding honey board and the supers adjusted above the brood as before. The queen, being separated from the brood by means of the excluder, lays few eggs in the comb on which she is confined during this period of separation. After a week or 10 days the queen cells are again destroyed, and the brood and queen are put back into a single hive body as before. This method gives results quite similar to the dequeening method (p. 35).

If every season were alike in a given locality the beekeeper could work out a manipulation to be applied to each colony just before or at the beginning of the honey flow, which would result in practically no swarming. The wide variation in the seasons, however, renders it next to impossible to adopt a swarm-control measure that will prove most profitable every year. The means of control adopted must be such as to favor the domination of the storing instinct. Probably the plan of making weekly visits is the most widely used system of swarm control by manipulation. When a colony is found preparing to swarm, the brood is removed if conditions are such as to justify doing so (p. 37). Otherwise the removal of the queen is resorted to.

With any of these methods of control the colony may rapidly restore former conditions, and even though it has been diverted from swarming may later again prepare to swarm and require a second manipulation. Generally speaking, when the honey flow is short, less radical measures are required. Colonies that have been supplied with young queens after a period of queenlessness have one factor

(the queen) changed with at least some degree of permanency. Colonies that have been compelled to construct a new set of brood combs from narrow strips of foundation have the most radical change of conditions as to brood rearing. Either of these changes alone is usually sufficient to insure no further preparations to swarm.

Manipulation of the Supers.

Proper manipulation of the comb-honey supers is not only a strong factor in the prevention of swarming but is also a stimulus to storing. The amount of room the colonies should have in the surplus apartment varies so much that the ordinary standard super is simply a unit in a large and flexible surplus apartment. If enough surplus room is given at the beginning of the season for the storage of the entire crop of honey, the space so given is too great for best results at the beginning of the honey flow, and little of it is needed at all if the season is poor. If, on the other hand, a single super is given and no other added until the first is completed, the room in the surplus apartment decreases from the time the super is given until the combs are completely drawn out, when there is little space left between the combs, the bees being practically crowded out. Thus while the population of the colony is increasing their room is being diminished—a condition highly conducive to swarming and less energetic work. After the super is filled, it is some time before the honey is ripened and sealed, ready to be removed. During this interval, if no other supers are given, there is no place for storage of the incoming nectar, and the comb builders must remain idle or waste their wax in building burr and brace combs. To avoid loss in this way, empty supers are added as they are needed, and the comb builders move from one super to another as their work in each is completed. The surplus apartment, whether consisting of a single super or several supers, should at all times contain some space for the comb builders.

If the honey flow is heavy and promises to continue, it is desirable to furnish not only sufficient room but to induce the bees to begin work in as many sections as possible, giving large comb surface for the storage and evaporation of the thin nectar, thus in a measure approximating extracted honey conditions.

There is a danger, however, that if the bees are induced to extend their work through too many supers, the sections when completed will be less well filled and therefore lighter in weight. Also, if the honey flow should not continue as expected a rapid expansion of the surplus apartment results in a large number of unfinished sections.

The rapidity of the expansion of work in the supers may to some extent be regulated by the position of each newly added super. If a rapid expansion is desirable, the empty super is placed below the

supers already on the hive, while if it seems best to crowd the bees somewhat the empty super is placed above those already on the hive. When the empty super is placed above the partly finished ones, the bees do not begin work therein unless they need the room. This practice is always desirable during a slow honey flow or toward the close of any honey flow, but when nectar is coming in rapidly does not result in a rapid expansion of comb building sufficient to avoid a more or less crowded condition, which in turn causes a loss of honey and increases the probability of swarming. If each super is supplied with one or two extracting combs (p. 16), this disadvantage of the practice of placing the empty super on top largely disappears, since the extracting combs are immediately available for the storage of nectar.

When the empty supers are placed under the partly filled ones, work in them is commenced promptly, but this may be at the expense of the nearly completed sections, which by this plan are moved farther from the brood chamber as each empty super is added. In

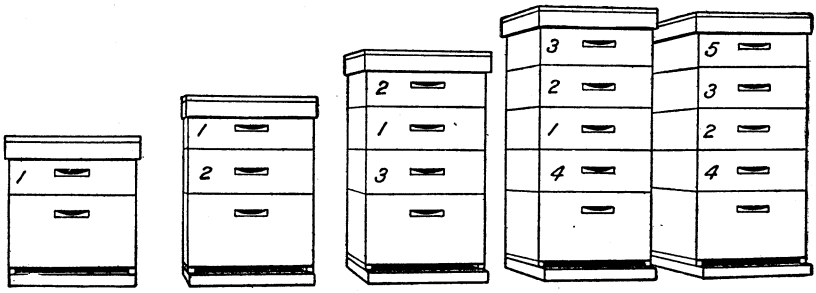

FIG. 19.—Arrangement of supers. (Original.)

the case of the super in which the honey is being sealed this distance is an advantage in so far as the whiteness of the cappings is concerned, but it may retard the completion of the work. An arrangement of the supers that to some extent avoids this difficulty is as follows: Except toward the close of the season, place each newly added super next to the brood chamber and keep the one nearest completion just above it with all others arranged above these two, the one in which least progress has been made being on top (fig. 19). Thus super No. 1 is raised up and No. 2 placed beneath it. When No. 3 is given, it is placed next to the brood chamber, while above it is No. 1 with No. 2 on top. If No. 4 is given, it is placed next to the brood chamber with Nos. 1, 2, and 3 in order above it. By this arrangement, if conditions justify doing so, strong colonies may be induced to expand their surplus apartment with great rapidity, since as soon as the foundation is well drawn in each newly added

super it may be transposed to the top and an empty one put in its place. Such rapid expansion of work in the supers should not be attempted, however, except during a heavy honey flow.

If early in the honey flow the bees are storing rapidly, strong colonies should be given a second super as soon as work has been fairly begun in the first. Colonies of medium strength may of course be allowed to do considerable work in the first super before the second is given, while a weak colony may have sufficient room for comb building until the first super is almost completed. The first super should contain some empty comb when given to the colony, and each succeeding super should be given in advance of the time when the bees would be in any way crowded without it. At no time should all the sections be removed and new supers containing only foundation be given, but the surplus apartment should contain sections in all the various stages of development. In this way there is no break in the work in the supers, and the critical periods, so far as the super room bears upon the problems of swarming and energetic work, are largely eliminated.

During the latter part of the honey flow the reasons for further expansion of the surplus apartment in excess of the immediate needs of the colonies (p. 41) no longer exist. At the beginning of a good honey flow the maximum of new work consistent with well-filled sections is desirable, while toward the close of the flow the beekeeper desires the minimum of new work consistent with sufficient room. The precise period when further expansion of the surplus apartment is no longer desirable and a concentration of the work already begun should take place is sometimes difficult to determine, and to do so requires a thorough knowledge of the locality and good judgment on the part of the beekeeper.

It is usually desirable to remove the honey as soon after it is finished as can well be done. If it is left on the hives too long after it is finished, it is likely to become discolored or "travel stained," while if it is taken off too soon some of the sections are not completed. It is desirable that the honey be removed by entire supers instead of by individual sections, therefore conditions should be made as favorable as possible for the completion of all the sections in a super without the more advanced ones becoming "travel stained." The bees are more inclined to stain the white surface of the combs toward the close of the honey flow or during very slow flows. Trouble from this source is at such time intensified because of the uneven progress of work in the different sections, the more advanced sections therefore being sealed some time before the super is sufficiently advanced to justify its removal. Another form of discoloration is brought about by the honey being sealed in close proximity to old and dark

brood combs, in which case some of the darker wax from the old combs is sometimes apparently used for capping the honey.

During a good honey flow all except the last supers may be left upon the hives until all or nearly all of the sections of honey are sealed, since (1) there is little trouble from "travel stain" when work is progressing rapidly, (2) all the sections in the super are ready to be sealed at about the same time, and (3) when there are several supers on each hive the one in which the honey is being sealed is at least one super removed from the brood combs.

Toward the close of the honey flow all supers having most of their sections finished should be removed and the sections sorted. The unfinished sections should be graded according to the degree of completion, the various grades placed in supers and given to such colonies as are most likely to finish them. Every effort should be made at this time to contract the surplus apartment, concentrating the work upon the sections nearest completion. All supers in which work has not yet been started should be removed and as soon as possible the surplus apartment of each colony should be reduced to one super. Though little room is necessary during the close of the honey flow, there should always be some room for the storage of new nectar until it is ripened. For such conditions extracting combs are valuable, since, instead of giving the last comb-honey super in which little work would be done, a set of extracting combs may be placed over the sections to afford room for the incoming nectar and comb surface for its ripening.

CARING FOR THE CROP.

Removing the Honey from the Hives.

If the honey flow is of considerable duration the major portion of the crop is removed before the flow ceases. At this time the removal of the finished supers is comparatively easy because the bees can readily be driven from them and also because the operator is not hindered in his work by robbing bees. At the close of the honey flow all the supers remaining upon the hives should be removed promptly, since to leave them on would result not only in some of the honey being carried down into the brood chamber but also in badly propolized sections. After the honey flow has ceased, great care should be exercised to keep bees from robbing. The use of bee-escapes (fig. 12) greatly facilitates the removal of the honey at any time, but their use is especially desirable in removing the honey remaining on the hives at the close of the honey flow. By their use the honey may be removed and stored in the honey house with little disturbance or excitement among the bees. The supers of

honey should of course be taken directly to the honey house or kept well covered [1] from robbers.

Before finally storing the supers of honey in the honey room those that are but partly filled may have their sections removed and sorted. The unfinished sections that can not be disposed of at a profit locally are usually put back into supers and the honey they contain is fed to the bees. This feeding is done by simply exposing the supers where the flying bees can have access to them. If there are few supers compared with the number of colonies they should be placed in piles and only a small entrance allowed, since if free access were given to a large number of bees they would tear the combs to pieces. When the bees have finished removing the honey from these unfinished sections the latter may be stored for future use as "bait" sections.

Care of Comb Honey.

In the honey room the supers of honey should be placed in piles in such a manner as to allow a free circulation of air between them. This may be done by "sticking them up" as lumber is piled to dry or by placing alternate supers crosswise. The air in the honey room should be kept as dry as possible. This is usually accomplished by means of a high temperature, the honey room being located on the sunny side of the building or directly under the roof. The windows should be opened only during dry weather. Ventilation of the honey room is of no value except when the air that is admitted contains less moisture than that already present. Otherwise ventilation may be a positive detriment. If a protracted period of rainy or damp weather should occur while the honey is in this storage it may be necessary to use artificial heat to dry the air in the honey room. Any great variation in temperature should be avoided, since it may cause a condensation of moisture on the surface of the cappings which will be absorbed by the honey.

Some beekeepers find it necessary to fumigate comb honey to prevent damage by the larvæ of the wax moth. For this purpose sulphur fumes or bisulphid of carbon may be used. If bisulphid of carbon is used, great care should be taken not to bring it near a flame, as it is highly inflammable.

Scraping Propolis from Sections.

Before being packed for market the sections of honey should be removed from the supers and the wood scraped free of propolis. A

[1] Honey from out-apiaries should be loaded for transportation in such a manner that the bees can not get at it, then before the horse is hitched to the wagon the load of honey should be drawn by hand some distance from the apiary if the slope of the ground will permit doing so. If this is not possible the horse may be attached by means of a long rope and the load drawn to a safe distance before the horse is hitched to the wagon.

convenient bench should be provided for this work, with a large shallow box or tray to catch the propolis as it is scraped from the sections. This work is usually done by hand, though a few producers have designed and are using machines for this purpose.

Grading Comb Honey.

The importance of properly grading and packing comb honey does not seem to be well understood by the average beekeeper. Some extensive buyers of comb honey find it profitable to regrade and repack practically all the comb honey they receive before sending it out to their trade. The producer of this honey of course bears this extra expense by receiving a lower price for his honey. The lack of uniformity of grading is to some extent a result of differences of opinion as to what should be the standard for the various grades. Grading rules have been of material aid toward greater uniformity, but various producers may use the same set of grading rules with very different results. It would be well if a single set of rules were in use, since honey from various localities may be sent to the same market. The grading rules in most common use are given in Farmers' Bulletin 447, page 39.

After scraping the propolis from the wood, each section of honey may be placed in a pile with others of its grade. Some put the sections directly into the shipping cases as fast as they are scraped, but better grading can be done if each grade is put in a separate pile and the final grading all done by one person. By thus having a large number of sections in each grade from which to select there is greater opportunity for making the sections of honey in each case more nearly uniform as to weight and the various shades of finish. Such uniformity is especially desirable from the standpoint of the retailer. Sections containing only a few cells of pollen should be placed in a lower grade or sold as culls, while those containing a considerable amount of pollen should not be marketed in the form of comb honey. An excessive amount of pollen in the sections is usually caused by the use of very shallow brood combs, extreme contraction of the brood chamber, or hiving swarms on narrow strips of foundation in the brood frames with partly drawn comb in the sections (p. 32).

Packages for Comb Honey.

Comb honey is usually packed in cases holding 24 sections (fig. 20). Other sizes are sometimes used to meet special market requirements. The markets have become accustomed to cases with glass fronts, by means of which the contents are displayed to advantage. However, in keeping with present practice in other package goods,

considerable comb honey is now placed on the market having each section inclosed in a carton. This practice, while losing the advantage of displaying the honey, has a decided advantage in insuring security from dust and insects while in the markets as well as greater safety to the fragile comb when the package is finally delivered to the consumer.

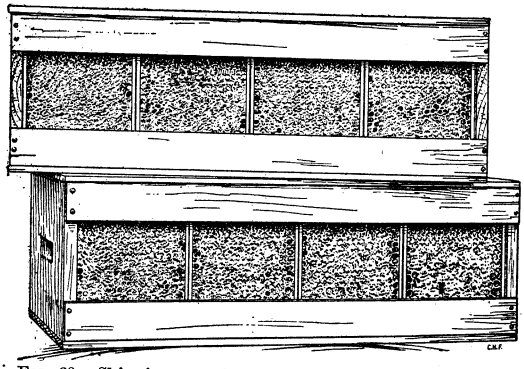

FIG. 20.—Shipping cases for comb honey. (From Phillips.)

Marketing.

Many beekeepers are able to dispose of their entire output of honey in their local markets, sometimes creating quite a demand for their product by advertising and demonstrating. Comb honey that is to be sent to a distant market should be shipped before cold weather, since the combs become extremely fragile when cold. Small lots should be crated in "carriers" holding several cases to prevent breakage by rough handling of individual cases, while in larger shipments the cases are simply packed in the car in such a manner that the individual cases can not be thrown about by the movement of the car.